Remarks

The Office Action mailed July 3, 2007 has been carefully reviewed and the foregoing amendment has been made in consequence thereof.

Claims 4, 5, 7-12, 16, 17, 19-21, and 25 are now pending in this application. Claims 4, 5, 7-12, 16, 17, 19-21, and 25 stand rejected. Claims 4, 16, and 25 have been amended. No new matter has been added.

The rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 under 35 U.S.C. § 103(a) as being unpatentable over Mattson et al. (U.S. Patent No. 5,229,934) ("Mattson") in view of Snyder et al. (U.S. Patent 5,923,775) ("Snyder"), Labaere et al. (U.S. Patent 5,717,791) ("Labaere") and Toth et al. (U.S. Patent 6,115,487) ("Toth"), and further in view of Florent et al. (U.S. Patent 5,594,845) ("Florent") is respectfully traversed.

Mattson describes a computed tomography imaging system. The computed tomography imaging system includes a threshold means (50). The threshold means compares a magnitude of a gradient of each pixel in an image memory with a preselected threshold (column 4, lines 49-51). The computed tomography imaging system further includes a forward projecting means that is indexed by a ray number counter (56) to forward project a data set along each ray of a gradient image representation in a gradient image memory (52) (column 4, lines 61-64).

Snyder describes a gradient estimation system. The gradient estimation system includes an original image. For each pixel in the original image, an estimate of a 2-D gradient is calculated (column 1, lines 65-67). For each image in a plurality of new images, corresponding pixels in a gradient image are examined (column 2, lines 8-9).

Labaere describes a digital image processing system. The digital imaging processing system includes a translation invariant representation, which is based on local gradient information on several scales (column 2, lines 53-55).

Toth describes a spectral correction system. The spectral correction system implements an image correction algorithm that can be applied for artifact correction, such as Z-slope correction (column 6, lines 34-36).

Florent describes a device that undertakes the function of reconstruction of a target image. Every pixel in the target image has a counterpart under projection with the same address in a projection image (column 2, lines 53-56).

Claim 4 recites a method for facilitating reconstruction of an image, the method comprising "estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images; generating a gradient image using the estimated gradient, wherein the gradient image represents a variation of the high density object in z; and generating an error-candidate projection using the gradient image, wherein to generate the error-candidate projection, said method further comprises forward projecting the gradient image along β, wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a method for facilitating reconstruction of an image as recited in Claim 4. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images, generating a gradient image using the estimated gradient, wherein the gradient image represents a variation of the high density object in z, and generating an error-candidate projection using the gradient image, wherein to generate the error-candidate projection, said method further comprises forward projecting the gradient image along β, wherein β represents a projection view angle. Rather, Mattson describes comparing a magnitude of a gradient of each pixel in an image memory with a preselected threshold and forward projecting a data set along each ray of a gradient image representation in a gradient image memory. Snyder describes calculating, for each pixel in an original image, an estimate of a 2-D gradient and examining, for each image in a plurality of new images, corresponding pixels in a gradient image. A description of examining,

for each image in a plurality of new images, corresponding pixels in a gradient image does not describe or suggest that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. Labaere describes generating a translation invariant representation based on local gradient information. Further, Toth describes a Z-slope correction. Florent describes generating a counterpart for every pixel in a target image. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. For at least the reasons set forth above, Claim 4 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claims 5, 7, 8, and 10-12 depend, directly or indirectly, from independent Claim 4. When the recitations of Claims 5, 7, 8, and 10-12 are considered in combination with the recitations of Claim 4, Applicant submits that dependent Claims 5, 7, 8, and 10-12 likewise are patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claim 16 recites a computer programmed to "estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images; generate a gradient image using the estimated gradient, wherein the gradient image represents a variation of the high density object in *z*; generate an error-candidate projection using the gradient image; and forward project the gradient image along β, wherein β represents a projection view angle."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computer programmed as recited in Claim 16. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computer programmed to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images, generate a gradient image using the estimated gradient, wherein the gradient image represents a

variation of the high density object in *z*, generate an error-candidate projection using the gradient image, and forward project the gradient image along β, wherein β represents a projection view angle. Rather, Mattson describes comparing a magnitude of a gradient of each pixel in an image memory with a preselected threshold and forward projecting a data set along each ray of a gradient image representation in a gradient image memory. Snyder describes calculating, for each pixel in an original image, an estimate of a 2-D gradient and examining, for each image in a plurality of new images, corresponding pixels in a gradient image. A description of examining, for each image in a plurality of new images, corresponding pixels in a gradient image does not describe or suggest that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. Labaere describes generating a translation invariant representation based on local gradient information. Further, Toth describes a Z-slope correction. Florent describes generating a counterpart for every pixel in a target image. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. For at least the reasons set forth above, Claim 16 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claims 17, 20, and 21 depend from independent Claim 16. When the recitations of Claims 17, 20, and 21 are considered in combination with the recitations of Claim 16, Applicant submits that dependent Claims 17, 20, and 21 likewise are patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Claim 25 recites a computed tomographic (CT) imaging system for reconstructing an image of an object, the imaging system comprising "a detector array; at least one radiation source; and a computer coupled to said detector array and said radiation source, said computer configured to: estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images; generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high

density object in z; and generate an error-candidate projection using the gradient image."

None of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computed tomographic imaging system for reconstructing an image of an object as recited in Claim 25. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests the computer configured to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images, generate a gradient image using the estimated gradient wherein the gradient image represents a variation of the high density object in z, and generate an error-candidate projection using the gradient image. Rather, Mattson describes comparing a magnitude of a gradient of each pixel in an image memory with a preselected threshold and forward projecting a data set along each ray of a gradient image representation in a gradient image memory. Snyder describes calculating, for each pixel in an original image, an estimate of a 2-D gradient and examining, for each image in a plurality of new images, corresponding pixels in a gradient image. A description of examining, for each image in a plurality of new images, corresponding pixels in a gradient image does not describe or suggest that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. Labaere describes generating a translation invariant representation based on local gradient information. Further, Toth describes a Z-slope correction. Florent describes generating a counterpart for every pixel in a target image. Accordingly, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. For at least the reasons set forth above, Claim 25 is submitted to be patentable over Mattson in view of Snyder, Labaere and Toth, and further in view of Florent.

Notwithstanding the above, Applicant respectfully submits that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 is not a proper rejection. It appears to the Applicant that the present rejection reflects an

impermissible attempt to use the instant claims as a guide or roadmap in formulating the rejection using impermissible hindsight reconstruction of the invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The United States Supreme Court has recently expressed concern regarding distortion caused by hindsight bias in an obvious analysis, and notes that "[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of argument reliant upon ex post reasoning." KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 82 USPQ2d at 1397. See also Ex parte Rinkevich, 2007 WL 1552288 (Bd. Pat. App. & Interf. May 29, 2007). Following the Supreme Court's guidance provided in KSR Int'l Co. v. Teleflex Inc. with respect to impermissible hindsight, a person of ordinary skill in the art having common sense at the time of the invention would not have reasonably looked to Mattson, Snyder, Labaere, Toth, or Florent to solve the problem associated with reducing artifacts in a manner described in the present patent application. Rather, such a suggestion is disclosed only in the present application. For at least this reason alone, Applicant requests that the Section 103 rejection be withdrawn.

Further, the Office Action only offers the conclusory statements that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have used the technique of Synder et al. to produce the gradient images, such as those in Labaere et al., used in Mattson et al. to estimate and reduce the noise or artifacts and thereby improve image quality" and that "it would have been obvious to one of ordinary skill in the art at the time of the invention to have scaled or weighted the error image of Mattson et al. with the method of Toth et al. in order to improve the error correction process" to suggest the combination of Mattson, with Snyder, Labaere, Toth, and Florent. Obviousness rejections must be supported with "articulated reasoning with some rational underpinning to support the conclusion of obviousness." See KSR International Co. v. Teleflex, Inc., 127 S. Ct. 1727 at 1740-41, 82 USPQ2d at 1396, citing In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). The

present rejection does not appear to meet this standard as it reflects no articulated reasoning why the independent or dependent claims are believed to be obvious, but rather is stated in the form of a conclusion of obviousness. Applicant accordingly requests specific explanation and articulation regarding the reasoning and rational underpinning for any obviousness rejection of the claims, or request that the Examiner remove the rejection. It is not believed that adequate reasons why the presently claimed invention is believed to be obvious have been provided on the present record. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection of Claims 4, 5, 7, 8, 10-12, 16, 17, 20, 21, and 25 be withdrawn.

The rejection of Claims 9 and 19 under 35 U.S.C. § 103(a) as being unpatentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore (U.S. Patent 4,222,104) ("Moore") is respectfully traversed.

Mattson, Snyder, Labaere, Toth, and Florent are described above. Moore describes a computed tomography system and method. The computed tomography system provides data signals for sets of radiation paths. All of the paths of a set are parallel to each other (column 4, lines 10-11). In the computed tomography method, a plurality of modified and interpolated path signals are back projected along a plurality of parallel paths into a matrix of points of an object (column 4, lines 11-13). For a second pass, the modified and interpolated signals are forward projected along parallel paths, corrected and once more back projected along the parallel paths (column 4, lines 13-15).

Claim 9 depends from independent Claim 4, which is recited above.

None of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a method for facilitating reconstruction of an image as recited in Claim 4. Specifically, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests estimating a gradient for at least one high-density object using a plurality of

reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images, generating a gradient image using the estimated gradient, wherein the gradient image represents a variation of the high density object in z, and generating an error-candidate projection using the gradient image, wherein to generate the error-candidate projection, said method further comprises forward projecting the gradient image along β, wherein β represents a projection view angle. Rather, Mattson describes comparing a magnitude of a gradient of each pixel in an image memory with a preselected threshold and forward projecting a data set along each ray of a gradient image representation in a gradient image memory. Snyder describes calculating, for each pixel in an original image, an estimate of a 2-D gradient and examining, for each image in a plurality of new images, corresponding pixels in a gradient image. A description of examining, for each image in a plurality of new images, corresponding pixels in a gradient image does not describe or suggest that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. Labaere describes generating a translation invariant representation based on local gradient information. Further, Toth describes a Z-slope correction. Florent describes generating a counterpart for every pixel in a target image. Moore describes backprojecting a plurality of modified and interpolated path signals along a plurality of parallel paths into a matrix of points of an object. For a second pass, the modified and interpolated signals are forward projected along parallel paths, corrected and once more back projected along the parallel paths. Accordingly, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. For at least the reasons set forth above, Claim 4 is submitted to be patentable over Mattson in view of Snyder, Labaere, Toth, and Florent, and further in view of Moore.

When the recitations of Claim 9 are considered in combination with the recitations of Claim 4, Applicant submits that dependent Claim 9 likewise is patentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore.

Claim 19 depends indirectly from Claim 16 which is recited above.

None of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a computer programmed as recited in Claim 16. Specifically, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests a computer programmed as recited in Claim 16. Specifically, none of Mattson, Snyder, Labaere, Toth, and Florent, considered alone or in combination, describes or suggests a computer programmed to estimate a gradient for at least one high-density object using a plurality of reconstructed images separated by a spacing s, wherein each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images, generate a gradient image using the estimated gradient, wherein the gradient image represents a variation of the high density object in *z*, generate an error-candidate projection using the gradient image, and forward project the gradient image along β, wherein β represents a projection view angle. Rather, Mattson describes comparing a magnitude of a gradient of each pixel in an image memory with a preselected threshold and forward projecting a data set along each ray of a gradient image representation in a gradient image memory. Snyder describes calculating, for each pixel in an original image, an estimate of a 2-D gradient and examining, for each image in a plurality of new images, corresponding pixels in a gradient image. A description of examining, for each image in a plurality of new images, corresponding pixels in a gradient image does not describe or suggest that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. Labaere describes generating a translation invariant representation based on local gradient information. Further, Toth describes a Z-slope correction. Florent describes generating a counterpart for every pixel in a target image. Moore describes backprojecting a plurality of modified and interpolated path signals along a plurality of parallel paths into a matrix of points of an object. For a second pass, the modified and interpolated signals are forward projected along parallel paths, corrected and once more back projected along the parallel paths. Accordingly, none of Mattson, Snyder, Labaere, Toth, Florent, and Moore, considered alone or in combination, describes or suggests that each of a plurality of values of the estimated gradient is a function of a plurality of values of the reconstructed images. For at least the reasons set forth above, Claim 16 is submitted to be patentable over Mattson in view of Snyder, Labaere Toth, and Florent, and further in view of Moore.

When the recitations of Claim 19 are considered in combination with the recitations of Claim 16, Applicant submits that dependent Claim 19 likewise is patentable over Mattson in view of Snyder, Labaere, Toth, Florent, and further in view of Moore.

Notwithstanding the above, Applicant respectfully submits that the Section 103 rejection of Claims 9 and 19 is not a proper rejection. It appears to the Applicant that the present rejection reflects an impermissible attempt to use the instant claims as a guide or roadmap in formulating the rejection using impermissible hindsight reconstruction of the invention. It is also impermissible to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art. The United States Supreme Court has recently expressed concern regarding distortion caused by hindsight bias in an obvious analysis, and notes that "[a] factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of argument reliant upon ex post reasoning." KSR Int'l Co. v. Teleflex Inc., 127 S. Ct. 1727, 82 USPQ2d at 1397. See also Ex parte Rinkevich, 2007 WL 1552288 (Bd. Pat. App. & Interf. May 29, 2007). Following the Supreme Court's guidance provided in KSR Int'l Co. v. Teleflex Inc. with respect to impermissible hindsight, a person of ordinary skill in the art having common sense at the time of the invention would not have reasonably looked to Snyder, Labaere Toth, Florent, or Moore to solve the problem associated with reducing artifacts in a manner described in the present patent application. Rather, such a suggestion is disclosed only in the present application. For at least this reason alone, Applicant requests that the Section 103 rejection be withdrawn.

Further, the Office Action only offers the conclusory statements that "[i]t would have been obvious to one of ordinary skill in the art at the time of the invention to have generated the error image from the gradient image through the use of a parallel beam forward projection in order to provide a simple procedure for the generation of the image" to suggest the combination of Snyder, with Labaere, Toth, Florent, and Moore. Obviousness rejections must be supported with "articulated reasoning with some rational underpinning to support the conclusion of obviousness." See KSR International Co. v. Teleflex, Inc., 127 S. Ct. 1727 at 1740-41, 82 USPQ2d

at 1396, citing In re Kahn, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness"). The present rejection does not appear to meet this standard as it reflects no articulated reasoning why the independent or dependent claims are believed to be obvious, but rather is stated in the form of a conclusion of obviousness. Applicant accordingly requests specific explanation and articulation regarding the reasoning and rational underpinning for any obviousness rejection of the claims, or request that the Examiner remove the rejection. It is not believed that adequate reasons why the presently claimed invention is believed to be obvious have been provided on the present record. Of course, such a combination is impermissible, and for this reason alone, Applicant requests that the Section 103 rejection of Claims 9 and 19 be withdrawn.

For at least the reasons set forth above, Applicant respectfully requests that the Section 103 rejection of Claims 9 and 19 be withdrawn.

In view of the foregoing amendment and remarks, all the claims now active in this application are believed to be in condition for allowance. Reconsideration and favorable action is respectfully solicited.

Respectfully submitted,

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